

**WHAT IS CLAIMED IS:**

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1. A thermoplastic polyurethane comprising the reaction product of:  
a polyol component including a randomly polymerized polyether  
polyol having a high secondary hydroxyl group content of about 20 to about  
100 percent based on the total number of hydroxyl group present in said  
high secondary polyether polyols;  
a polyisocyanate;  
a chain extender; and  
optionally, a polyurethane catalyst.

2. The thermoplastic polyurethane according to claim 1, wherein  
said thermoplastic polyurethane is substantially linear, and wherein said  
thermoplastic polyurethane has a molecular weight of from about 75,000 to  
about 400,000 weight average.

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3. The thermoplastic polyurethane according to claim 2, wherein  
said polyol component has a number average molecular weight of from  
about 600 to about 5,000, and wherein said polyol component has a  
hydroxyl functionality of from about 1.8 to about 2.2.

4. The thermoplastic polyurethane according to claim 3, wherein said polyol component includes in an amount up to about 50 weight percent of a polyol having low secondary hydroxyl group content, and wherein said high secondary polyether polyol has been derived in the presence of a double metal cyanide catalyst.

5. The thermoplastic polyurethane according to claim 4, wherein the mole ratio of polyisocyanate functional groups to hydroxyl functional groups of the polyol component and the chain extender is from about 0.95 to about 1.10.

6. The thermoplastic polyurethane according to claim 5, wherein said polyisocyanate comprises diphenylmethane-4,4'-diisocyanate (MDI), or methylene bis(4-cyclohexylisocyanate), or combinations thereof, and wherein said chain extender is 1,4-butanediol, ethylene glycol, diethylene glycol, 1,6-hexane diol, 1,4-cyclohexanedimethanol (HQEE), 1,4-benzenedimethylol, or combinations thereof.

7. The thermoplastic polyurethane according to claim 6, wherein said high secondary polyether polyol has a secondary hydroxyl group content of about 51 to about 100 percent.

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8. The thermoplastic polyurethane according to claim 3, wherein said thermoplastic polyurethane has a molecular weight from about 125,000 to about 300,000, wherein said high secondary polyether polyol has a secondary hydroxyl group content of about 40 to about 70%, and wherein the mole ratio of polyisocyanate functional groups to hydroxyl functional groups of the polyol component and the chain extender is from about 0.98 to about 1.03.

9. The thermoplastic polyurethane according to claim 2, wherein said high secondary polyether polyol has a secondary hydroxyl group content of about 51 to about 100 percent, wherein said high secondary polyether polyol is a propylene oxide copolymer having at least 60% by weight of propylene oxide repeat units, and wherein said polyol component has hydroxyl functionality of from about 1.95 to about 2.05.

10. The thermoplastic polyurethane according to claim 7, wherein said polyol component includes less than or equal to 15 weight percent of said polyol having low secondary hydroxyl group content, and wherein said polyurethane catalyst is present in an amount from about 20 to about 500 parts by weight per million parts by weight of the total weight of said polyisocyanate, said polyol component, and said chain extender.

11. The thermoplastic polyurethane according to claim 7, wherein said thermoplastic polyurethane has a molecular weight from about 150,000 to about 250,000.

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12. The thermoplastic polyurethane according to claim 1, wherein said polyurethane is in the form of a film having a thickness from about 0.5 mils to about 10 mils.

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13. The thermoplastic polyurethane according to claim 12, wherein said polyurethane film has a moisture vapor transmission rate greater than 2,000 grams per square meter per day.

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14. The thermoplastic polyurethane according to claim 7, wherein said polyurethane is in the form of a film having a thickness from about 0.5 mils to about 10 mils.

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15. The thermoplastic polyurethane according to claim 14, wherein said polyurethane film has a moisture vapor transmission rate greater than 2,000 grams per square meter per day.

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16. A polyurethane composition, comprising:  
a polyol component including a randomly polymerized polyether polyol having a high secondary hydroxyl group content of about 20 to about

100 percent based on the total number of hydroxyl groups present in said high secondary polyether polyol,

a polyisocyanate;

a chain extender; and

optionally, a polyurethane catalyst,

said polyurethane being a thermoplastic substantially free of cross-links.

17. The polyurethane composition according to claim 16, wherein said thermoplastic polyurethane is substantially linear, and wherein said thermoplastic polyurethane has a molecular weight of from about 75,000 to about 400,000 weight average.

Sub A5 18. The polyurethane composition according to claim 17, wherein said polyol component has a number average molecular weight of from about 600 to about 5,000, and wherein said polyol component has hydroxyl functionality of from about 1.8 to about 2.2.

19. The polyurethane composition according to claim 18, wherein said polyol component includes up to about 50 weight percent of a polyol having low secondary hydroxyl group content, and wherein said high secondary polyether polyol has been derived in the presence of a double metal cyanide catalyst.



functional groups of the polyol component and the chain extender is from about 0.98 to about 1.03.

5           24. The polyurethane composition according to claim 17, wherein said high secondary polyether polyol has a secondary hydroxyl group content of about 51 to about 100 percent, wherein said high secondary polyether polyol is a propylene oxide copolymer having at least 60% by weight of propylene oxide repeat units, and wherein said polyol component  
10           has a hydroxyl functionality of from about 1.95 to about 2.05.

          25. The polyurethane composition according to claim 22, wherein said polyol component includes less than or equal to 15 weight percent of said polyol having low secondary hydroxyl group content, and wherein said  
15           polyurethane catalyst is present in an amount from about 20 to about 500 parts by weight per million parts by weight of the total weight of said polyisocyanate, said polyol component, and said chain extender.

          26. The polyurethane composition according to claim 22, wherein  
20           said thermoplastic polyurethane has a molecular weight from about 150,000 to about 250,000.

27. The polyurethane composition according to claim 16, wherein said polyurethane has been formed into a film having a thickness from about 0.5 mils to about 10 mils.

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28. The polyurethane composition according to claim 27, wherein said polyurethane film has a moisture vapor transmission rate greater than 2,000 grams per square meter per day.

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~~29. A polyurethane composition according to claim 22, wherein said polyurethane has been formed into a film having a thickness from about 0.5 mils to about 10 mils.~~

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~~30. The polyurethane composition according to claim 22, wherein said polyurethane film has a moisture vapor transmission rate greater than 2,000 grams per square meter per day.~~

~~31. A process for preparing a thermoplastic polyurethane composition, comprising:~~

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~~reacting in substantially a single step a composition comprising:~~

~~a) a polyol component including a randomly polymerized polyether polyol having a high secondary hydroxyl group content of about 20 to about 100 percent based on the total number of hydroxyl group present in said polyether polyol;~~



a polyisocyanate;  
a chain extender; and  
optionally, a polyurethane catalyst.

5            32. The process for preparing a thermoplastic polyurethane composition according to claim 31, wherein said thermoplastic polyurethane is substantially linear, and wherein said thermoplastic polyurethane has a molecular weight of from about 75,000 to about 400,000 weight average.

10            <sup>SUB</sup><sub>AB</sub> 33. The process for preparing a thermoplastic polyurethane composition according to claim 32, wherein said polyol component has a number average molecular weight of from about 600 to about 5,000, and wherein said polyol component has hydroxyl functionality of from about 1.8 to about 2.2.

15            34. The process for preparing a thermoplastic polyurethane composition according to claim 33, wherein said polyol component includes up to about 50 weight percent of a polyol having low secondary hydroxyl group content, and wherein said high secondary polyether polyol has been  
20            derived in the presence of a double metal cyanide catalyst.

             35. The process for preparing a thermoplastic polyurethane composition according to claim 34, wherein the mole ratio of polyisocyanate

functional groups to the total hydroxyl functional groups of the polyol component and the chain extender is from about 0.95 to about 1.10.

5            36. The process for preparing a thermoplastic polyurethane composition according to claim 35, wherein said polyisocyanate comprises diphenylmethane-4,4'-diisocyanate (MDI), or methylene bis(4-cyclohexylisocyanate), or combinations thereof, and wherein said chain  
10            diol, 1,4-cyclohexanedimethanol (HQEE), 1,4-benzenedimethylol, or combinations thereof.

15            37. The process for preparing a thermoplastic polyurethane composition according to claim 36, wherein said random polyether polyol has a secondary hydroxyl group content of about 51 to about 100 percent.

20            38. The process for preparing a thermoplastic polyurethane composition according to claim 37, wherein said thermoplastic polyurethane has a molecular weight from about 125,000 to about 300,000, wherein said high secondary polyether polyol has a secondary hydroxyl group content of about 40 to about 70%, and wherein the mole ratio of polyisocyanate functional groups to the total hydroxyl functional groups of the polyol component and the chain extender is from about 0.98 to about 1.03.

39. The process for preparing a thermoplastic polyurethane composition according to claim 38, wherein said high secondary polyether polyol has a secondary hydroxyl group content of about 51 to about 100 percent, wherein

said high secondary polyether polyol is a propylene oxide copolymer having at least 60% by weight of propylene oxide repeat units, and wherein said polyol component has a hydroxyl functionality of from about 1.95 to about 2.05.

40. The process for preparing a thermoplastic polyurethane composition according to claim 39, wherein said polyol component includes less than or equal to 15 weight percent of said polyol having low secondary hydroxyl group content, and wherein said polyurethane catalyst is present in an amount from about 20 to about 500 parts by weight per million parts by weight of the total weight of said polyisocyanate, said polyol component, and said chain extender.

41. The process for preparing a thermoplastic polyurethane composition according to claim 40, wherein said thermoplastic polyurethane has a molecular weight from about 150,000 to about 250,000.

42. The process for preparing a thermoplastic polyurethane composition according to claim 41, wherein said polyurethane has been formed into a film having a thickness from about 0.5 mils to about 10 mils.

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43. The process for preparing a thermoplastic polyurethane composition according to claim 42, wherein said polyurethane film has a moisture vapor transmission rate greater than 2,000.

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44. The process for preparing a thermoplastic polyurethane composition according to claim 43, wherein said polyurethane has been formed into a film having a thickness from about 0.5 mils to about 10 mils.

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45. The process for preparing a thermoplastic polyurethane composition according to claim 44, wherein said polyurethane film has a moisture vapor transmission rate greater than 2,000 grams per square meter per day.

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